

PRELIMINARY DATA SUMMARY

August 1990

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

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CERC Field Research Facility
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Measurements and Analysis work units at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility (FRF) in Duck, North Carolina. The FRF staff collected and analyzed these data. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

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PART I: INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC's) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Figure 1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The research pier is a reinforced concrete structure supported on 0.9-m-diam steel piles spaced 12.2 m apart along the pier's length and 4.6 m apart across the width. The pier deck is 6.1 m wide and extends from behind the duneline to about the 6-m water depth contour at a height of 7.6 m above the National Geodetic Vertical Datum (NGVD). In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Questions and/or comments concerning the data may be directed to Mr. Michael W. Leffler at (919) 261-3511.

Part II presents the meteorological data; Parts III through VI present oceanographic data; Part VII presents nearshore profiles and bathymetry; and Part VIII, if included, documents special events that occurred at the FRF during the month.

Table 1 is a list of instruments used, their operational status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depths at the wave gages and current meters vary and may be determined from information contained in Figure 7. Other installation information is contained in Table 1.

Times given in the report, unless otherwise specified, are referenced to eastern standard time (EST).

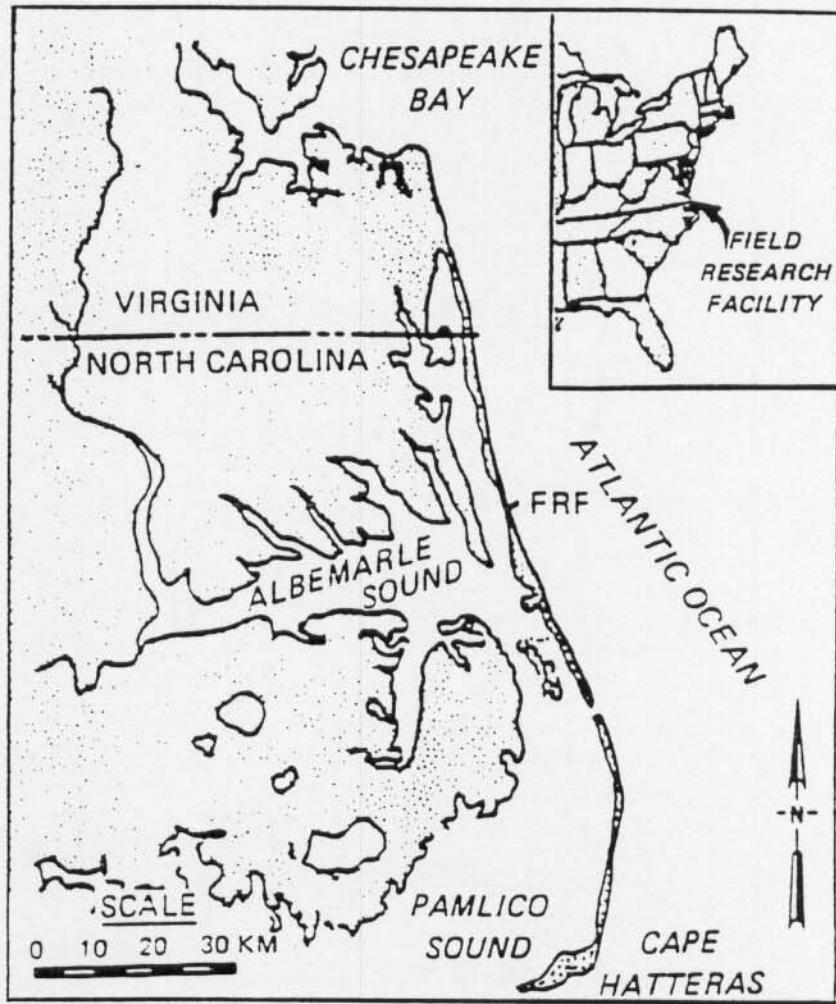


Figure 1. FRF location map

Table 1: Instrument Status/Data Availability

AUG 1990

Gage ID	Description/Remarks	Depth at Sensor		Day of the month																																		
				1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1				
616	Barometric Pressure		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Analog Record	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
604	Precipitation		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
624	Air Temperature		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
932	Anemometer at seaward end of pier Elevation 19 m (NGVD)		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
645	Baylor staff at station 7+80 on FRF pier	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
625	Baylor staff at station 18+60 on FRF pier	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
111	Pressure gage 309 m north of FRF pier (0.9 km offshore)	Approx. 7.8 m NGVD	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
630	Waverider buoy 6.0 km offshore	Approx. 23 m NGVD	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
519	Current meter 320 m north of FRF pier (0.9 km offshore)	see Figure 7	Gage Status	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
			Data Collected	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
865-1370	NOAA tide station at seaward end of FRF pier		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Supplemental Observations (daily oceanographic and meteorological observations)		Daily observation	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Gage Status	Daily Observation	Analog Record	Data Collected
Operational = *	Complete = *	Complete = *	All = *
Partial = /	Partial = /	Partial = /	Partial = /
Non-Operational = -	None = -	None = -	None = -

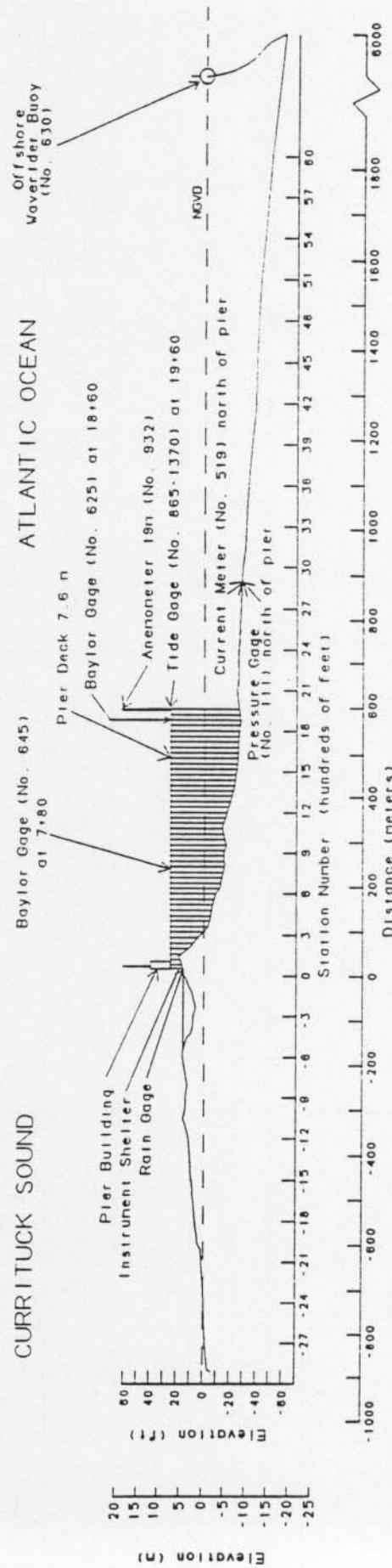
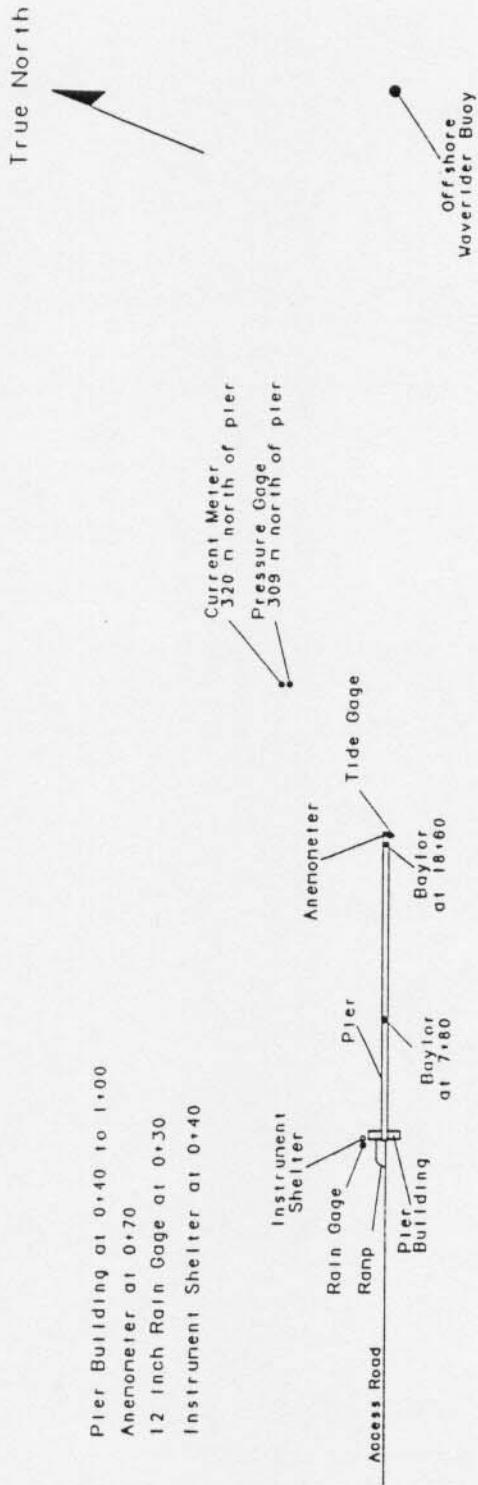


Figure 2. Instrument locations at FRF (all elevations from NGVD, all distances from FRF baseline).

PART II: METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Figure 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

Winds were measured at the end of the pier at an elevation of 19 m (Figure 2) using a Weather Measure Skyvane anemometer.

Monthly resultant wind speeds and directions are determined by vector averaging the data. Temperature and atmospheric pressure means are the average of the values presented for the month. Total precipitation is the sum for the month.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in.) -
 $mm \times .03937 = in.$
2. Millibars (mb) to inches of mercury (in. Hg) -
 $mb \times 0.02953 = in. Hg$
3. Degrees Celsius (C) to degrees Fahrenheit (F) -
 $(C \times 9/5) + 32 = F$
4. Meters per second (m/s) to knots (kn) -
 $m/s \times 1.943 = kn$

Table 2: Meteorological Data

Aug 1990

Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
1	100	7	5	26.3	1010.4	0
	700	10	351	24.6	1013.1	0
	1300	5	21	25.9	1014.5	0
	1900	6	358	24.5	1014.5	0
2	100	5	358	24.3	1016.2	0
	700	4	302	23.9	1017.2	0
	1300	5	16	27.2	1017.5	0
	1900	3	60	24.3	1016.9	0
3	100	2	81	23.8	1017.2	0
	700	4	332	24.1	1017.2	0
	1300	4	47	27.0	1017.2	0
	1900	3	69	24.0	1016.2	0
4	100	1	11	18.3	1016.5	0
	700	3	3	24.9	1016.9	0
	1300	2	53	28.3	1016.5	0
	1900	4	77	24.5	1015.9	0
5	100	2	227	23.0	1016.2	0
	700	3	188	25.7	1016.5	0
	1300	7	140	29.6	1016.2	0
	1900	9	186	26.6	1014.5	0
6	100	7	202	25.7	1015.5	0
	700	6	200	25.4	1015.5	0
	1300	5	171	25.0	1014.5	0
	1900	7	183	25.8	1012.5	0
7	100	6	204	25.3	1013.5	0
	700	4	240	24.8	1013.8	0
	1300	4	49	*	*	26
	1900	0		22.8	1015.2	0
8	100	0		22.3	1015.9	3
	700	0		22.7	1017.2	3
	1300	0		23.1	1017.9	10
	1900	5	82	24.6	1017.2	0
9	100	4	141	23.9	1016.9	0
	700	4	114	25.1	1016.9	0
	1300	6	155	25.9	1016.5	5
	1900	6	106	24.7	1015.2	0
10	100	3	139	24.2	1013.8	0
	700	2	78	23.1	1013.5	3
	1300	5	77	27.3	1013.5	0
	1900	2	349	24.3	1012.5	0
11	100	3	289	23.8	1013.5	0
	700	3	258	25.5	1014.5	0
	1300	2	227	28.9	1015.2	0
	1900	5	165	26.3	1015.5	0
12	100	5	221	25.4	1016.5	0
	700	3	269	25.5	1018.2	0
	1300	4	137	29.8	1018.2	0
	1900	5	184	26.7	1017.9	0
13	100	5	219	25.8	1018.2	0
	700	4	238	26.0	1018.6	0
	1300	5	147	30.9	1017.5	0
	1900	8	198	27.3	1015.9	0
14	100	7	237	25.6	1015.2	0
	700	5	249	26.5	1015.5	0
	1300	3	59	29.9	1015.5	0
	1900	1	95	24.1	1015.9	0
15	100	2	11	23.7	1015.9	0
	700	3	185	26.1	1016.5	0
	1300	4	94	29.5	1016.5	0
	1900	4	155	26.5	1015.2	0
16	100	2	305	24.2	1015.2	0
	700	3	24	26.0	1015.9	0
	1300	5	109	28.0	1015.5	0
	1900	6	52	26.1	1015.5	0

* electronic problems

(Continued)

Table 2: Meteorological Data

Aug 1990

<u>Day</u>	<u>Hour</u>	<u>Wind Speed m/sec</u>	<u>Wind Direction deg TN</u>	<u>Temperature deg C</u>	<u>Atm Pressure mb</u>	<u>Precipitation mm</u>
17	100	3	62	25.1	1015.2	0
	700	6	59	26.5	1016.2	0
	1300	5	48	28.0	1016.2	0
	1900	4	44	25.9	1015.5	0
18	100	2	147	24.7	1015.5	0
	700	3	26	26.9	1015.9	0
	1300	5	80	29.4	1015.9	0
	1900	3	139	26.3	1014.5	0
19	100	2	204	25.3	1014.5	0
	700	2	276	27.0	1014.5	0
	1300	6	139	30.7	1014.2	0
	1900	5	182	27.5	1013.5	0
20	100	4	236	26.4	1014.2	0
	700	4	228	26.7	1015.5	0
	1300	3	263	29.7	1015.2	0
	1900	8	4	24.5	1015.5	0
21	100	9	343	23.0	1016.2	0
	700	7	314	21.3	1016.9	0
	1300	8	353	23.8	1017.2	0
	1900	4	344	22.4	1015.2	0
22	100	4	339	21.6	1015.5	0
	700	4	318	22.3	1015.2	0
	1300	4	18	27.0	1014.2	0
	1900	1	54	24.6	1013.5	0
23	100	2	122	24.5	1013.1	0
	700	4	132	25.0	1013.5	0
	1300	*	*	26.9	1013.1	0
	1900	6	121	25.1	1012.1	0
24	100	3	79	24.9	1012.5	0
	700	2	127	25.4	1012.8	0
	1300	4	166	24.8	1013.8	3
	1900	1	234	21.3	1014.5	0
25	100	3	301	22.9	1015.5	0
	700	3	354	24.1	1017.5	0
	1300	3	96	25.3	1018.6	0
	1900	4	235	24.7	1017.5	0
26	100	5	202	24.8	1016.9	0
	700	4	317	19.2	1017.2	8
	1300	2	39	29.2	1016.2	0
	1900	5	139	25.3	1014.8	0
27	100	3	245	25.5	1014.2	0
	700	4	317	25.3	1013.8	0
	1300	5	27	28.8	1012.8	0
	1900	0	*	26.3	1011.1	0
28	100	4	251	27.3	1009.4	0
	700	6	334	27.0	1010.4	0
	1300	2	104	31.0	1009.8	0
	1900	4	229	29.0	1008.1	0
29	100	4	226	27.6	1008.4	0
	700	5	238	27.5	1007.0	0
	1300	5	242	31.8	1006.4	0
	1900	9	284	23.4	1006.0	0
30	100	5	269	23.2	1007.0	0
	700	6	326	22.8	1008.4	3
	1300	13	27	25.4	1010.8	0
	1900	8	34	24.0	1011.8	0
31	100	11	39	24.1	1013.5	0
	700	12	39	24.7	1015.2	0
	1300	*	*	*	*	0
	1900	9	27	25.1	1017.2	0
<u>Resultant</u>				<u>Mean</u>	<u>Mean</u>	<u>Total</u>
0				25.5	1014.7	64

PART III: WAVE DATA

Wave data are collected from two Baylor staff gages (Gages 625 and 645), a pressure wave gage (Gage 111) and a Waverider buoy (Gage 630) as shown in Table 1 and Figure 2. The data are collected, analyzed, and stored on magnetic tape using a Digital Equipment Corporation VAX 11/750 programmed to sample the wave gages every 6 hr (more frequently during storms) beginning at 0100, 0700, 1300, and 1900 EST. The sampling rate is two times per second for four contiguous 34-min records.

Wave height H_{mo} is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. Wave height reported from the pressure gage has been compensated for hydrodynamic attenuation using linear wave theory. Wave period is identified from the computation of a variance (energy) spectrum with 60 deg of freedom calculated from a 34-min record. Peak wave period T_p is defined as the period associated with the maximum energy in the spectrum. When this analysis is complete, the data are written to magnetic tape.

Table 3 presents the wave heights and periods for each wave record obtained at 6 hr intervals during the month. The monthly means and standard deviations from the means shown in Table 3 are average values computed from this data. Figure 3 is a time history of all H_{mo} and T_p values obtained for all gages.

Differences in wave periods between wave gages (Table 3 and Figure 3) may be the result of wave breaking, wave reformation, or the presence of multiple wave trains containing nearly equal energy.

Table 3: Wave Data

Aug 1990

Day	Hour	645		625		111		630	
		Baylor at 7+80 Hmo.m	L.sec	Baylor at 18+60 Hmo.m	L.sec	Pressure Gage Hmo.m	Lsec	Offshr Wvrdr Hmo.m	L.sec
1	0100	1.07	12.19	1.51	12.19	1.76	12.19	1.49	12.19
	0700	1.28	12.19	1.59	11.64	1.70	11.64	1.77	12.80
	1300	1.09	6.24	1.39	11.13	1.39	6.09	1.47	10.67
	1900	1.02	5.82	1.13	9.48	1.21	9.85	1.21	10.67
2	0100	0.90	9.85	1.09	8.83	1.14	9.14	1.15	9.48
	0700	0.67	5.95	0.77	10.67	0.86	8.26	0.86	10.67
	1300	0.54	10.67	0.73	10.67	0.73	9.85	0.77	10.67
	1900	0.54	9.48	0.77	8.83	0.81	9.14	0.78	8.83
3	0100	0.56	10.24	0.76	9.85	0.75	8.00	0.77	9.14
	0700	0.47	9.85	0.61	9.85	0.64	9.85	0.58	9.85
	1300	0.44	9.14	0.62	8.83	0.53	9.14	0.59	9.14
	1900	0.32	9.14	0.50	8.83	0.51	9.14	0.58	8.53
4	0100	0.32	9.14	0.47	8.53	0.52	9.14	0.55	8.83
	0700	0.27	8.83	0.44	9.14	0.45	8.83	0.45	8.83
	1300	0.24	8.53	0.48	7.76	0.51	7.53	0.50	8.26
	1900	0.29	9.48	0.41	9.14	0.44	8.26	0.48	7.76
5	0100	0.23	12.80	0.35	7.76	0.38	9.14	0.39	9.48
	0700	0.19	9.85	0.28	8.26	0.35	12.80	0.34	9.48
	1300	0.34	2.72	0.45	12.80	0.33	9.85	0.52	2.98
	1900	0.26	10.67	0.32	10.67	0.36	9.14	0.49	10.24
6	0100	0.22	9.85	0.30	10.24	0.32	10.24	0.38	10.24
	0700	0.22	9.85	0.31	9.85	0.31	9.48	0.37	10.24
	1300	0.20	9.14	0.32	9.48	0.32	9.85	0.34	9.48
	1900	0.26	9.14	0.32	8.83	0.35	9.85	0.50	8.53
7	0100	0.22	8.83	0.31	9.14	0.35	9.14	0.37	9.48
	0700	0.24	9.48	0.33	8.83	0.42	8.83	0.39	8.26
	1300	0.21	8.26	0.35	9.48	0.38	8.26	*	
	1900	0.25	9.14	0.32	9.48	0.36	9.48	0.39	8.26
8	0100	0.22	9.14	0.37	7.76	0.36	9.14	0.38	9.14
	0700	0.26	9.48	0.38	9.14	0.42	9.14	0.46	8.83
	1300	0.23	11.64	0.41	12.19	0.41	11.64	0.44	11.64
	1900	0.41	10.67	0.56	11.13	0.51	12.80	0.57	11.13
9	0100	0.41	12.80	0.58	12.80	0.53	10.67	0.58	11.13
	0700	0.40	12.19	0.63	11.64	0.60	12.19	0.59	12.19
	1300	0.42	12.19	0.64	12.19	0.62	12.19	0.68	11.64
	1900	0.58	11.64	0.80	11.64	0.77	11.13	0.75	11.13
10	0100	0.41	4.57	0.69	11.13	0.64	10.24	0.59	10.24
	0700	0.48	4.74	0.71	10.67	0.72	11.13	0.69	10.67
	1300	0.48	10.24	0.70	10.67	0.67	9.48	0.69	5.33
	1900	0.45	10.67	0.70	10.24	0.75	10.24	0.83	5.57
11	0100	0.32	10.24	0.55	9.85	0.60	10.24	0.63	9.85
	0700	0.28	9.14	0.50	9.14	0.56	9.85	0.58	8.83
	1300	0.28	9.48	0.47	9.85	0.52	9.48	0.53	9.48
	1900	0.36	5.82	0.58	8.00	0.61	9.48	0.70	5.82
12	0100	0.27	9.85	0.43	9.85	0.46	10.24	0.56	6.40
	0700	0.23	9.14	0.43	9.14	0.48	9.14	0.53	6.74
	1300	0.29	9.14	0.42	9.14	0.45	9.14	0.49	9.14
	1900	0.25	9.14	0.38	9.48	0.41	9.48	0.52	8.00
13	0100	0.24	9.48	0.37	9.48	0.39	9.14	0.45	9.48
	0700	0.20	8.83	0.34	9.85	0.37	9.14	0.41	8.83
	1300	0.24	9.14	0.33	8.83	0.38	9.14	0.37	8.53
	1900	0.31	3.20	0.41	8.83	0.40	3.37	0.51	8.83
14	0100	0.23	9.48	0.35	8.26	0.40	9.14	0.43	7.53
	0700	0.20	8.26	0.31	8.83	0.35	9.48	0.36	8.53
	1300	0.26	9.14	0.33	9.85	0.39	10.67	0.43	5.57
	1900	0.20	11.64	0.31	8.26	0.35	8.00	0.39	7.31
15	0100	0.22	10.67	0.32	7.53	0.35	7.11	0.40	8.53
	0700	0.24	7.76	0.34	9.85	0.38	10.67	0.39	6.92
	1300	0.26	10.24	0.36	10.67	0.38	10.67	0.46	9.48
	1900	0.27	10.67	0.41	8.83	0.35	10.67	0.43	8.83
16	0100	0.32	3.88	0.44	10.67	0.48	10.24	0.47	9.14
	0700	0.25	9.48	0.40	9.85	0.41	10.67	0.45	9.48
	1300	0.34	10.67	0.48	10.67	0.45	10.24	0.50	9.14
	1900	0.37	10.67	0.55	8.26	0.53	10.24	0.57	9.14

* Electronic problems

(Continued)

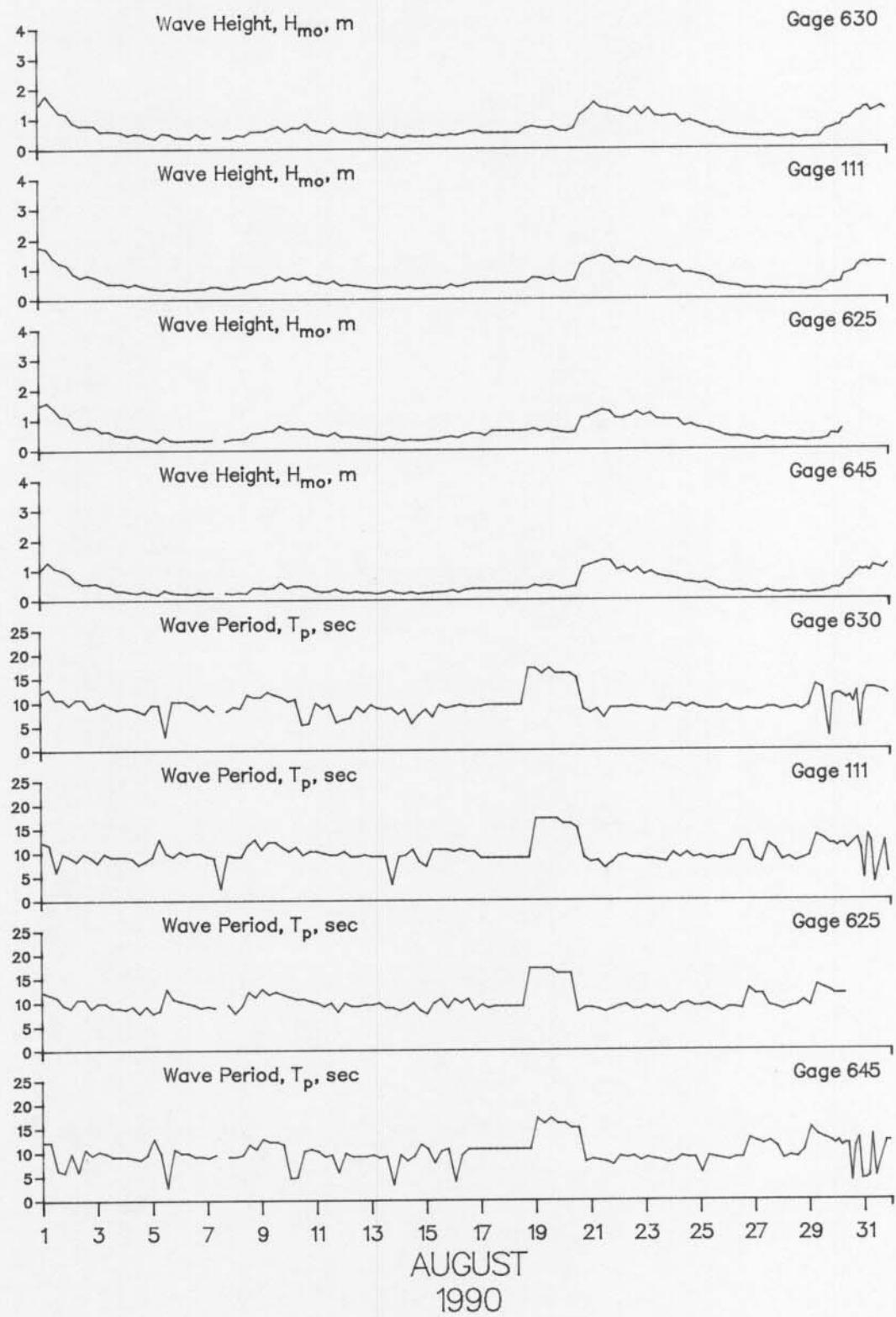
Table 3: Wave Data

Aug 1990

Day	Hour	645		625		111		630	
		Baylor at 7+80	Hmo.m T.sec	Baylor at 18+60	Hmo.m T.sec	Pressure Gage	Hmo.m T.sec	Offshrd Wvrdr	Hmo.m T.sec
17	0100	0.34	21.33	0.54	9.48	0.54	8.83	0.58	9.14
	0700	0.31	21.33	0.46	8.83	0.49	21.33	0.51	9.48
	1300	0.42	19.69	0.62	9.14	0.55	19.69	0.59	19.69
	1900	0.48	19.69	0.59	19.69	0.65	19.69	0.56	19.69
18	0100	0.39	18.29	0.59	19.69	0.60	19.69	0.62	19.69
	0700	0.37	18.29	0.58	18.29	0.60	18.29	0.56	18.29
	1300	0.43	18.29	0.61	18.29	0.59	18.29	0.60	18.29
	1900	0.41	18.29	0.64	17.07	0.62	18.29	0.67	17.07
19	0100	0.49	17.07	0.70	17.07	0.71	17.07	0.73	17.07
	0700	0.44	16.00	0.61	17.07	0.70	17.07	0.68	16.00
	1300	0.47	17.07	0.67	17.07	0.62	17.07	0.65	17.07
	1900	0.44	16.00	0.62	16.00	0.69	17.07	0.70	16.00
20	0100	0.35	16.00	0.57	16.00	0.56	16.00	0.58	16.00
	0700	0.40	15.06	0.54	16.00	0.58	16.00	0.57	16.00
	1300	0.44	15.06	0.56	8.00	0.62	15.06	0.65	15.06
	1900	1.07	8.00	1.05	8.83	1.15	8.83	1.12	8.53
21	0100	1.15	8.53	1.10	8.83	1.29	8.00	1.28	7.76
	0700	1.23	8.26	1.22	8.53	1.36	8.26	1.51	8.53
	1300	1.31	8.00	1.31	8.00	1.43	6.74	1.34	6.74
	1900	1.30	7.31	1.26	8.53	1.38	7.76	1.30	8.83
22	0100	0.99	9.14	1.04	9.14	1.18	9.14	1.26	8.83
	0700	1.05	8.83	1.03	9.48	1.20	9.48	1.17	8.83
	1300	0.89	9.14	1.10	8.53	1.14	8.83	1.12	9.14
	1900	1.03	8.26	1.23	8.53	1.37	8.83	1.34	8.83
23	0100	0.83	8.83	1.12	9.14	1.26	8.53	1.10	8.83
	0700	0.92	8.53	1.19	8.53	1.21	8.53	1.30	8.26
	1300	0.79	8.26	1.00	8.83	1.09	8.26	1.06	8.26
	1900	0.73	7.76	0.98	7.76	1.09	8.00	1.03	8.00
24	0100	0.71	8.00	0.98	8.26	1.03	9.85	1.06	9.48
	0700	0.65	9.14	0.98	9.48	1.06	8.83	1.06	9.48
	1300	0.56	8.83	0.76	9.85	0.85	9.85	0.83	8.83
	1900	0.55	8.83	0.81	9.14	0.85	8.83	0.90	9.48
25	0100	0.51	5.69	0.71	9.14	0.80	9.14	0.82	8.83
	0700	0.54	9.14	0.68	9.48	0.76	8.53	0.74	8.53
	1300	0.45	8.83	0.61	8.83	0.67	8.83	0.64	8.53
	1900	0.33	8.53	0.52	8.00	0.49	8.53	0.64	8.53
26	0100	0.30	8.26	0.43	8.83	0.46	8.83	0.52	9.14
	0700	0.26	8.83	0.38	8.83	0.41	9.14	0.44	8.26
	1300	0.26	8.83	0.39	8.53	0.40	12.19	0.41	8.00
	1900	0.25	12.80	0.35	12.80	0.33	12.19	0.40	8.53
27	0100	0.19	12.19	0.30	11.64	0.32	8.53	0.37	8.26
	0700	0.19	11.64	0.28	11.64	0.33	7.76	0.36	8.26
	1300	0.28	12.19	0.36	9.14	0.29	11.64	0.36	8.83
	1900	0.21	11.13	0.30	8.83	0.31	10.67	0.37	8.83
28	0100	0.19	8.53	0.29	8.26	0.31	8.26	0.33	8.26
	0700	0.22	9.14	0.28	8.83	0.28	8.83	0.35	8.53
	1300	0.21	8.83	0.30	9.14	0.28	8.00	0.39	8.83
	1900	0.21	10.24	0.27	10.24	0.28	8.53	0.29	8.26
29	0100	0.18	15.06	0.25	9.14	0.26	9.14	0.32	9.14
	0700	0.20	13.47	0.28	13.47	0.30	13.47	0.32	13.47
	1300	0.22	12.80	0.28	12.80	0.31	12.80	0.34	12.80
	1900	0.28	12.19	0.35	12.19	0.44	11.64	0.60	2.75
30	0100	0.36	11.13	0.48	11.64	0.42	11.64	0.55	11.64
	0700	0.44	11.13	0.63	11.64	0.56	11.64	0.68	11.13
	1300	0.67	10.67	*	*	*	*	0.90	10.24
	1900	0.92	12.80	*	1.05	10.24	1.13	11.64	
31	0100	0.94	4.74	*	1.32	4.49	1.27	11.64	
	0700	1.01	4.74	*	1.10	10.67	1.32	12.80	*
	1300	1.04	5.02	*	1.37	12.19			
	1900	0.99	12.19	*	1.09	12.19	1.38	12.19	
Mean		0.47	10.35	0.59	10.38	0.65	10.52	0.68	9.99
Std dev		0.30	3.53	0.30	2.64	0.35	3.10	0.33	3.09

* Electronic problems

(Sheet 2 of 2)



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PART IV: CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, longshore currents flow either toward 340 deg (i.e. northward) or toward 160 deg (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second (cm/sec). Resultant speeds and directions are determined by vector averaging the data.

Table 4: Current Data
Aug 1990

Day	Alongshore Cross-shore Resultant Time	Pier Measurements				Beach Measurements (500m Updrift)				Current Meter	
		Dye at (579 m) (surface)	Distance from Baseline (m)	Dye Zone (surface)	Speed Dir	12m offshore (surface)	Location	Speed Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519	Speed Dir	
1	0100-Along Cross Result										
1	0700-Along Cross Result	61 0	S 160	213	41 30 51	S off 123	North	43	S		
1	1300-Along Cross Result										
1	1900-Along Cross Result										
2	0100-Along Cross Result										
2	0700-Along Cross Result	44 0	S 160	140	32 29 43	S on 202	North	15	S		
2	1300-Along Cross Result										
2	1900-Along Cross Result										
3	0100-Along Cross Result										
3	0700-Along Cross Result	41 0	S 160	128	68 7 68	S off 154	North	14	N		
3	1300-Along Cross Result										
3	1900-Along Cross Result										
4	0100-Along Cross Result										
4	0700-Along Cross Result	15 0	S 160	128	41 6 41	S off 151	North	47	S		
4	1300-Along Cross Result										
4	1900-Along Cross Result										
5	0100-Along Cross Result										
5	0700-Along Cross Result	17 2	N off	128	23 0 23	N 0 340	South	10	N		
5	1300-Along Cross Result	17 346									
5	1900-Along Cross Result										

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Continued)
Aug 1990

Day	Time	Pier Measurements				Beach Measurements (500m Updrift)				Current Meter	
		Alongshore Cross-shore Resultant		Dye at (579 m) surface	Distance from Baseline (m)	Dye 12m offshore (surface)		Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519
		Speed	Dir								
6	0100-Along Cross Result										
6	0700-Along Cross Result	24 2 25	N on 334		128	23 11 26	N on 316	South	5	N	
6	1300-Along Cross Result										
6	1900-Along Cross Result										
7	0100-Along Cross Result										
7	0700-Along Cross Result	29 4 29	S off 151	128	38 29 48	N on 303	South	2	N		
7	1300-Along Cross Result										
7	1900-Along Cross Result										
8	0100-Along Cross Result										
8	0700-Along Cross Result	23 6 24	N on 326	128	7 2 8	N on 323	South	11	S		
8	1300-Along Cross Result										
8	1900-Along Cross Result										
9	0100-Along Cross Result										
9	0700-Along Cross Result	14 8 16	S on 191	140	23 28 36	N on 289	South	9	N		
9	1300-Along Cross Result										
9	1900-Along Cross Result										
10	0100-Along Cross Result										
10	0700-Along Cross Result	4 3 5	N on 303	140	55 42 69	N on 303	South	65	N		
10	1300-Along Cross Result										
10	1900-Along Cross Result										

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Aug 1990

Alongshore Cross-shore Resultant ---- Time Day	Pier Measurements				Beach Measurements (500m Updrift)				Current Meter	
	Dye at (579 m) (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519	
11 0100-Along Cross Result										
11 0700-Along Cross Result	4 4 6	N off 28	140	44 28 52	N on 307	South	26	N		
11 1300-Along Cross Result										
11 1900-Along Cross Result										
12 0100-Along Cross Result										
12 0700-Along Cross Result	1 6 6	S off 82	140	47 7 47	N on 331	South	3	N		
12 1300-Along Cross Result										
12 1900-Along Cross Result										
13 0100-Along Cross Result										
13 0700-Along Cross Result	7 9 11	N on 289	165	11 33 35	N on 268	South	28	N		
13 1300-Along Cross Result										
13 1900-Along Cross Result										
14 0100-Along Cross Result										
14 0700-Along Cross Result	17 13 21	N off 17	140	6 4 7	N off 11	South	13	N		
14 1300-Along Cross Result										
14 1900-Along Cross Result										
15 0100-Along Cross Result										
15 0700-Along Cross Result	28 0 28	N off 340	165	29 70 75	N on 273	South	28	N		
15 1300-Along Cross Result										
15 1900-Along Cross Result										

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Aug 1990

Alongshore Cross-shore Resultant Time	Pier Measurements				Beach Measurements				Current Meter	
	Dye at (579 m) (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519	
Day	Speed	Dir							Speed	Dir
16 0100-Along Cross Result										
16 0700-Along Cross Result	51 23 56	S on 184	152	21 19 28	N on 298	South	5	N		
16 1300-Along Cross Result										
16 1900-Along Cross Result										
17 0100-Along Cross Result										
17 0700-Along Cross Result	47 16 50	S on 179	140	10 22 24	N on 274	South	20	N		
17 1300-Along Cross Result										
17 1900-Along Cross Result										
18 0100-Along Cross Result										
18 0700-Along Cross Result	34 3 34	S on 166	140	8 3 9	N off 2	South	14	N		
18 1300-Along Cross Result										
18 1900-Along Cross Result										
19 0100-Along Cross Result										
19 0700-Along Cross Result	0 6 6	— off 70	140	87 0 87	N — 340	South	27	N		
19 1300-Along Cross Result										
19 1900-Along Cross Result										
20 0100-Along Cross Result										
20 0700-Along Cross Result	4 2 4	S off 129	140	44 65 78	N on 284	South	11	N		
20 1300-Along Cross Result										
20 1900-Along Cross Result										

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Aug 1990

Alongshore Cross-shore Resultant Time Day	Pier Measurements				Beach Measurements				Current Meter				
	Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	(500m Updrift)	Dye 12m offshore (surface)	Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519
21 0100-Along Cross Result													
21 0700-Along Cross Result	61 3 off	S 157		128	68 85 108	S on 211		North	40	S			
21 1300-Along Cross Result													
21 1900-Along Cross Result													
22 0100-Along Cross Result													
22 0700-Along Cross Result	61 24 off	S 138		140	68 51 85	S on 197		North	11	S			
22 1300-Along Cross Result													
22 1900-Along Cross Result													
23 0100-Along Cross Result													
23 0700-Along Cross Result	13 2 off	N 349		140	44 13 45	S off 143		North	13	S			
23 1300-Along Cross Result													
23 1900-Along Cross Result													
24 0100-Along Cross Result													
24 0700-Along Cross Result	12 9 on	S 197		140	34 7 35	N on 329		North	9	S			
24 1300-Along Cross Result													
24 1900-Along Cross Result													
25 0100-Along Cross Result													
25 0700-Along Cross Result	55 0	S 160		140	25 4 26	N off 349		North	16	S			
25 1300-Along Cross Result													
25 1900-Along Cross Result													

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Aug 1990

Day	Alongshore Cross-shore Resultant Time	Pier Measurements				Beach Measurements				Current Meter	
		Dye at (579 m) (surface)	Speed	Dir	Dye at Mid-Surf Zone (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed
26 0100-Along Cross Result											
26 0700-Along Cross Result	27 4 27	S off 151			128	36 0 36	N 340		North	8 S	
26 1300-Along Cross Result											
26 1900-Along Cross Result											
27 0100-Along Cross Result											
27 0700-Along Cross Result	2 3 4	N on 277			140	16 8 18	N off 7		South	5 N	
27 1300-Along Cross Result											
27 1900-Along Cross Result											
28 0100-Along Cross Result											
28 0700-Along Cross Result	47 9 48	S on 171			140	17 10 20	N off 11		North	4 S	
28 1300-Along Cross Result											
28 1900-Along Cross Result											
29 0100-Along Cross Result											
29 0700-Along Cross Result	0 12 12	— off 70			140	29 0 29	N 340		South	21 N	
29 1300-Along Cross Result											
29 1900-Along Cross Result											
30 0100-Along Cross Result											
30 0700-Along Cross Result	23 6 24	S on 174			140	47 23 52	N on 313		South	24 N	
30 1300-Along Cross Result											
30 1900-Along Cross Result											

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Concluded)
Aug 1990

Alongshore Cross-shore Resultant Time Day	Pier Measurements				Beach Measurements				Current Meter	
	Dye at (579 m) (surface)	Dye at Mid-Surf Zone (surface)	Distance from Baseline	Speed	Dye 12m offshore (surface)	Location	Speed	Dir	0.9 km Offshore (NGVD) Depth -5.6m ID #519	Dir
31 0100-Along Cross Result										
31 0700-Along Cross Result	12 0 12	S off 160	140	5 5 7	S off 115	South	12	N		
31 1300-Along Cross Result										
31 1900-Along Cross Result										

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

PART V: SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves but not surface chop or capillary waves) are taken daily at the seaward end of the pier. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring the alignment of the wave crests at approximately the same location as the visual measurements. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 deg east of true north; consequently, wave angles greater than 70 deg indicate that the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are also taken daily at the seaward end of the pier. A jar along with a thermometer is lowered about 0.3 m into the water and allowed to remain for at least one minute. The jar is removed, the temperature read, and a hydrometer is used to determine the density. A Secchi disc is used to determine the surface visibility.

Table 5: Supplemental Observations

Aug 1990

Day	Time	Wave Approach			Width of Surf Zone.m	Water Characteristics at Pier End		
		Primary	Secondary	Radar Wave Angle deg from True N		Temp.,C	Density g/cc	Secchi Vis.,m
1	0738	90	20	inoperative	213	26.7	1.0200	2.4
2	0730	50		inoperative	44	26.7	1.0187	5.2
3	0720	60	70	inoperative	47	27.2	1.0176	5.8
4	0710	75		inoperative	35	26.7	1.0171	5.5
5	0630	80		inoperative	20	27.2	1.0173	4.9
6	0720	90	105	inoperative	17	25.0	1.0216	4.0
7	0718	105		inoperative	9	24.4	1.0221	4.0
8	0705	110		inoperative	29	25.0	1.0215	5.5
9	0825	100		inoperative	12	25.6	1.0184	4.3
10	0830	105	80	inoperative	58	25.0	1.0204	4.3
11	0655	95	45	inoperative	40	25.6	1.0212	4.9
12	0800	110	75	inoperative	49	25.6	1.0211	4.3
13	0725	105		inoperative	53	25.6	1.0209	5.8
14	0715	105		inoperative	31	24.4	1.0215	4.6
15	0815	90	45	inoperative	52	26.7	1.0206	7.6
16	0710	75		inoperative	44	27.2	1.0182	2.7
17	0635	95	65	inoperative	46	27.2	1.0186	2.4
18	0740	95	50	inoperative	40	27.2	1.0185	3.7
19	0740	90		inoperative	50	27.8	1.0194	2.7
20	0700	110		inoperative	38	26.1	1.0211	4.0
21	0700	50		inoperative	55	26.7	1.0208	2.1
22	0724	50		inoperative	85	26.5	1.0184	4.0
23	0515	65	45	inoperative	61	26.5	1.0250	1.8
24	0650	60		inoperative	82	26.7	1.0194	0.9
25	0700	80	30	inoperative	55	26.5	1.0182	4.9
26	0740	80		inoperative	30	26.5	1.0192	3.4
27	0740	95		inoperative	43	26.1	1.0189	3.7
28	0725	100		inoperative	43	27.5	1.0166	3.7
29	0720	105		inoperative	35	27.2	1.0168	3.7
30	0740	90	10	inoperative	59	27.2	1.0176	4.9
31	0740	35	100	inoperative	85	26.7	1.0182	2.4

PART VI: WATER LEVELS

Since 1978, the National Oceanic and Atmospheric Administration (NOAA)/National Ocean Service (NOS) has operated a primary tide station (No. 865-1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect instantaneous water level data every 6 minutes throughout the month.

The variation in water level during the month is shown in Figure 4 along with a list of mean and extreme values. This presentation is useful in identifying effects of both meteorological and astronomical forces on the open coast water level.

Table 6 contains the time at the center of each 12.42-hr tidal cycle and the range, high, low, and mean water levels during each tidal cycle.

FRF Tide Heights

Aug 1990

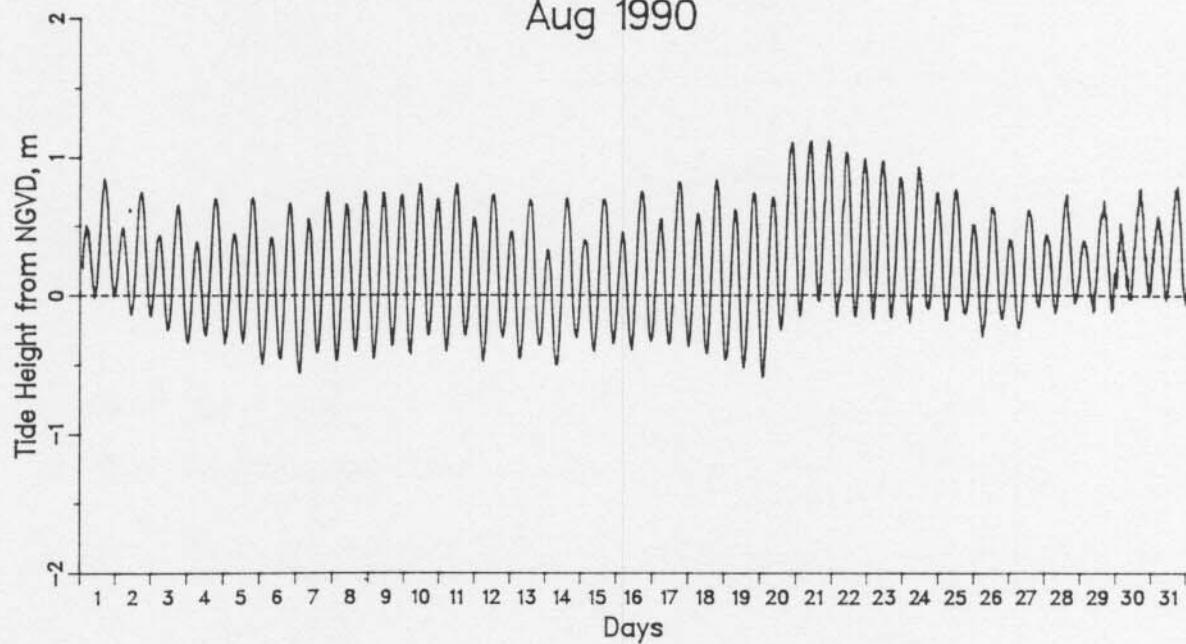


Figure 4. Water Level Time History

Monthly Water Levels, m NGVD

Extreme Low = -0.59 on day 20 at 42 EST
Extreme High = 1.12 on day 21 at 2000 EST
Monthly Mean = 0.20
Mean Low = -0.28
Mean High = 0.68
Mean Range = 0.95

Table 6: Water Levels.m NGVD

Day	Mid-Cycle Time	Low	High	Mean	Range
1	612	-0.02	0.50	0.26	0.52
1	1837	-0.01	0.84	0.40	0.85
2	703	-0.14	0.49	0.18	0.63
2	1928	-0.15	0.74	0.30	0.89
3	753	-0.25	0.43	0.11	0.68
3	2018	-0.34	0.65	0.15	0.99
4	843	-0.29	0.38	0.06	0.67
4	2109	-0.35	0.70	0.19	1.05
5	934	-0.34	0.44	0.08	0.78
5	2159	-0.49	0.70	0.11	1.20
6	1024	-0.46	0.41	0.00	0.87
6	2249	-0.56	0.66	0.05	1.22
7	1115	-0.41	0.55	0.07	0.96
7	2340	-0.47	0.74	0.13	1.21
8	1205	-0.40	0.65	0.14	1.05
9	30	-0.46	0.75	0.14	1.20
9	1255	-0.37	0.74	0.18	1.11
10	121	-0.43	0.72	0.15	1.15
10	1346	-0.29	0.80	0.25	1.09
11	211	-0.41	0.69	0.16	1.10
11	1436	-0.29	0.80	0.23	1.09
12	301	-0.48	0.56	0.06	1.03
12	1527	-0.30	0.73	0.20	1.03
13	352	-0.45	0.45	0.02	0.91
13	1617	-0.36	0.69	0.15	1.05
14	442	-0.50	0.32	-0.07	0.82
14	1707	-0.30	0.70	0.18	1.01
15	532	-0.40	0.40	0.03	0.80
15	1758	-0.35	0.69	0.18	1.04
16	623	-0.39	0.45	0.04	0.84
16	1848	-0.33	0.75	0.22	1.08
17	713	-0.35	0.55	0.10	0.90
17	1938	-0.37	0.82	0.24	1.19
18	804	-0.42	0.59	0.09	1.01
18	2029	-0.46	0.83	0.18	1.29
19	854	-0.52	0.62	0.05	1.13
19	2119	-0.59	0.74	0.10	1.33
20	944	-0.25	0.70	0.22	0.95
20	2210	-0.15	1.11	0.49	1.26
21	1035	-0.05	1.12	0.54	1.16
21	2300	-0.16	1.12	0.47	1.28
22	1125	-0.16	1.03	0.43	1.19
22	2350	-0.17	0.99	0.41	1.16
23	1216	-0.16	0.97	0.41	1.13
24	41	-0.20	0.85	0.34	1.05
24	1306	-0.10	0.93	0.38	1.02
25	131	-0.18	0.74	0.27	0.92
25	1356	-0.13	0.76	0.29	0.90
26	222	-0.30	0.51	0.12	0.80
26	1447	-0.17	0.63	0.22	0.80
27	312	-0.24	0.40	0.08	0.64
27	1537	-0.08	0.61	0.26	0.69
28	402	-0.12	0.44	0.18	0.56
28	1628	-0.06	0.73	0.30	0.78
29	453	-0.12	0.39	0.17	0.51
29	1718	-0.12	0.68	0.30	0.80
30	543	-0.03	0.52	0.21	0.55
30	1808	0.00	0.77	0.37	0.77
31	634	-0.04	0.57	0.27	0.61
31	1859	-0.06	0.79	0.39	0.85

PART VII: NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Zeiss surveying system; a Zeiss Elta-2 first-order, self-recording electronic theodolite distance meter in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m-high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in July and the only survey in August on profile line 188, located 517 m south of the pier. A significant amount of erosion on the foreshore (80 - 120 m) was accompanied by deposition on the nearshore bar (160 - 280 m).

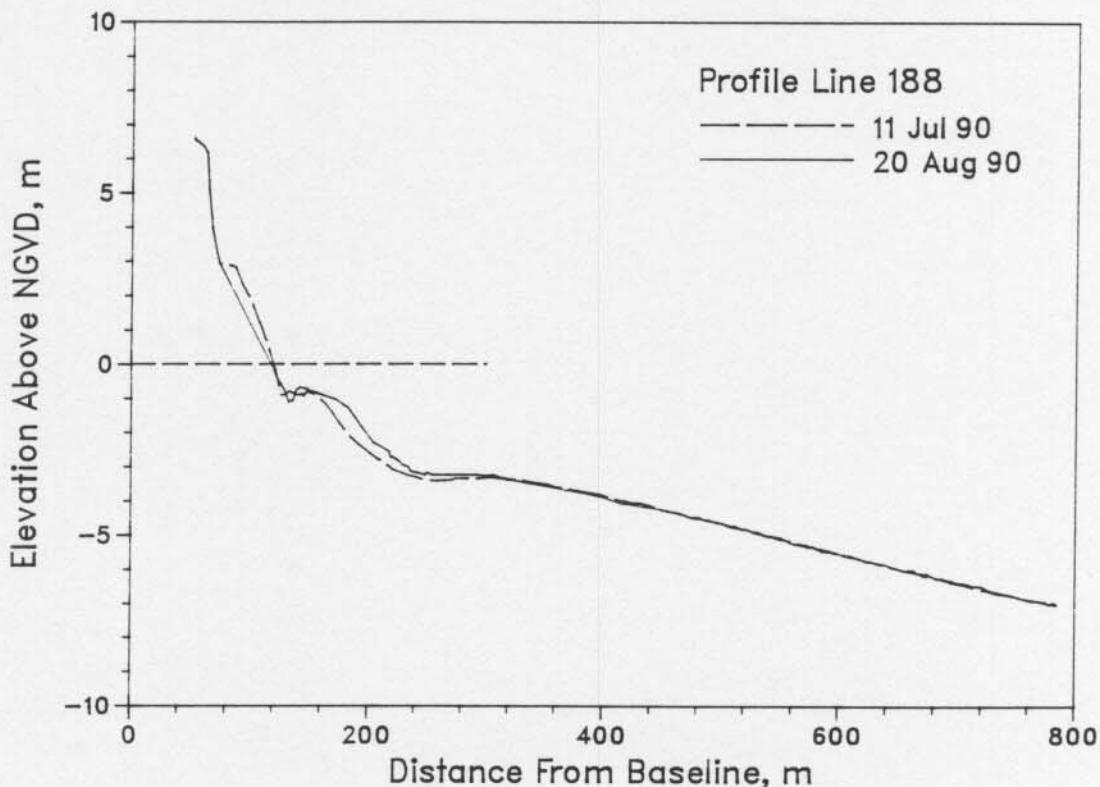


Figure 5. Monthly CRAB profiles on profile 188 - 517 m south of pier.

The profile envelope (Figure 6) reflects the maximum changes that occurred on the profile during 1990. The small changes to the envelope (80 and 260 m) were caused by the erosion on the foreshore and the accretion on the nearshore bar.

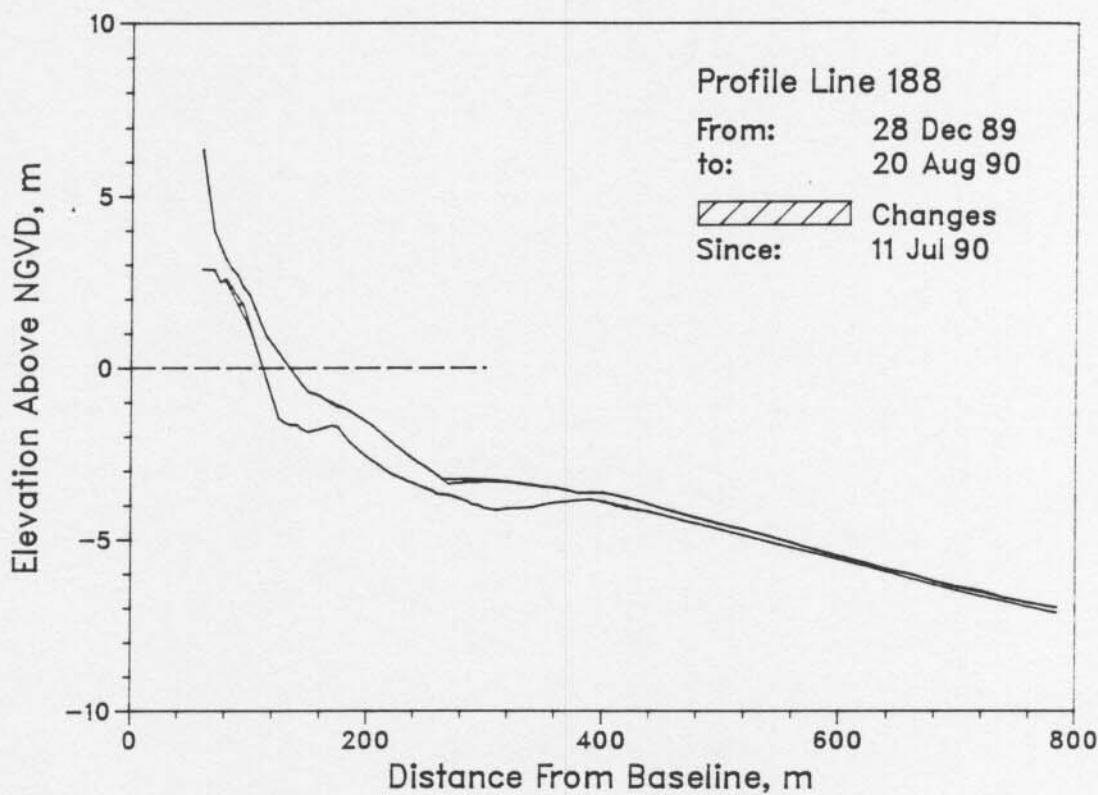


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. Figure 7 includes a two- and three-dimensional contour map and a change plot derived from the bathymetric survey on 27 June. Wide contour lines on the change diagram represent eroded areas; thin lines indicate deposition. There was no bathymetric survey during August, the June survey is included for reference.

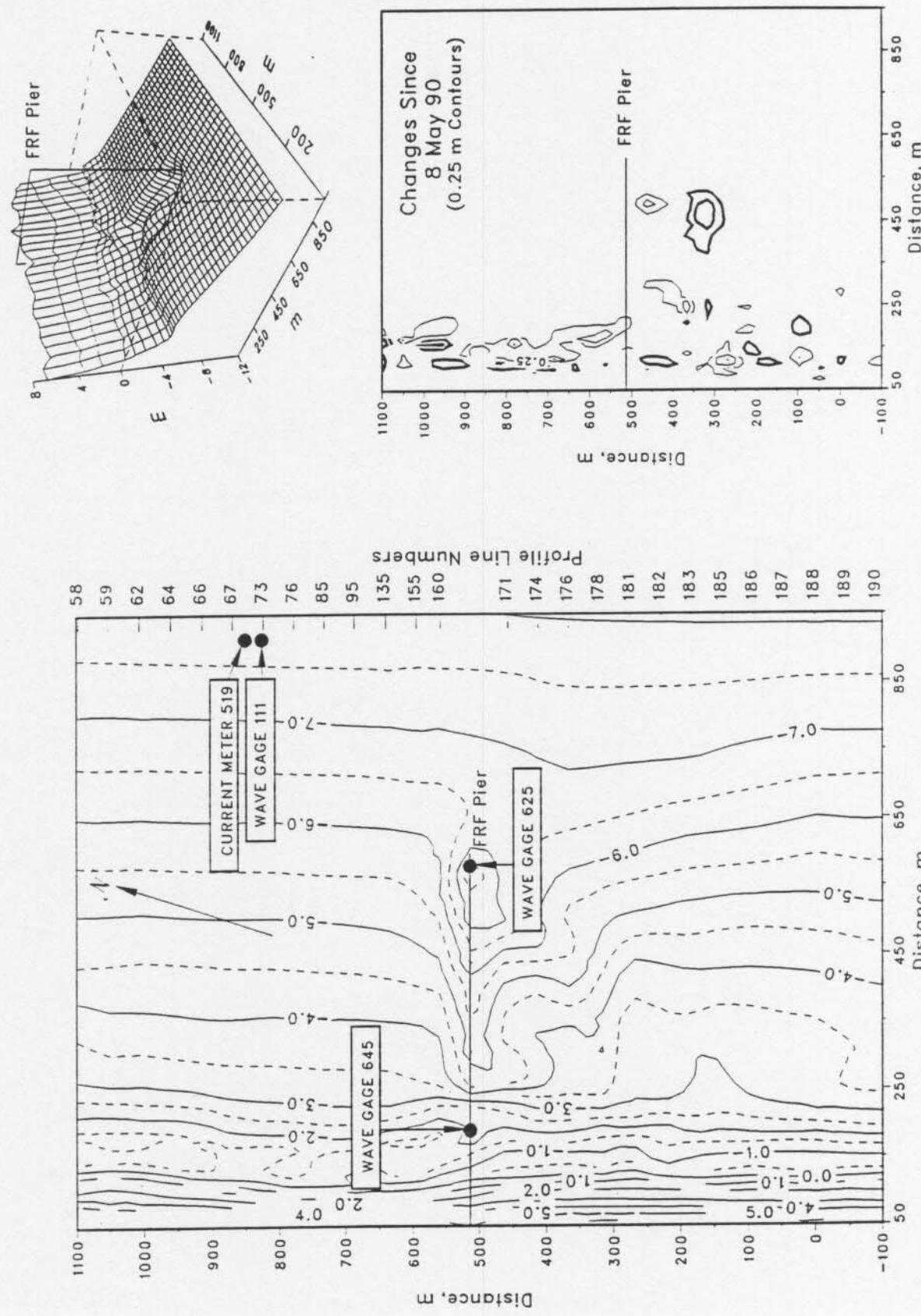


Figure 7. FRF bathymetry 27 Jun 90 depths relative to NGVD

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